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UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
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EROSION CONTROL PRACTICES DIVISION

Soil Conservation Economics- E. L. Sauer, Urbana, Illinois.-"An abstract of 'Dividends from Conservation Farming' was prepared for the Journal of Biological Abstracts as follows: 'Sauer, Elmer L. (Conservation Economics Research, USDA, and Ill. Agr. Exp. Sta., Urbana) / Dividends from conservation farming. / Jour. Soil and Water Conservation / 4(1): 34-38, 1949.--Comparative analysis of 786 matched farms alike in physical characteristics but different in the degree to which they applied conservation practices shows that money spent on conservation is a sound investment. Complete capital costs of a farm conservation program averaged \$35 an acre in 1947. Conservation farming increased net farm income in one to four years. Per acre net income on high-conservation farms for ten years, 1936-45, averaged \$3.46, or 25 percent higher than on low-conservation farms. Increased crop yields and livestock production accounted for most of difference in earnings between high-and low conservation farms. Yield increases for crops grown on contour compared with farming up and down slope on the same Illinois farms, seven year average, 1939-45, ranged from 12 percent for corn to 17 percent for wheat. Labor, power, and machinery costs per crop acre averaged \$18.66 for contour-tilled farms and \$19.86 for farms not contour tilled. In each of four areas studied, high-conservation farms had higher returns per \$100 of feed fed and produced more pounds of milk and meat per acre than low-conservation farms."

Soil and Water Conservation and Crop Yield in Relation to Different Systems of Soil Management - "In preparation for a coming farmers' meeting data have been summarized on soil losses, water losses, and crop yield from tomatoes and sweet corn grown under different systems of soil management. In one case these crops are grown in sequence with other cultivated crops on land that is cultivated each year. No winter cover crop is used in this treatment. In the second case tomatoes and sweet corn are

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** All research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

grown in a 3-year rotation with a clover-grass sod crop. Winter cover of rye is grown between the two cultivated seasons. A 10 ton per acre compost application is made once in each 3-year period. The clover-grass mixture is seeded in early fall following sweet corn. The sod crop occupies the land during the winter of seeding, all the next season, and the following winter.

"During growing seasons only, the soil loss by erosion from tomatoes in the sod rotation system has averaged 60% less than the loss under tomatoes on continuously cultivated land. Water loss by runoff has been 68% less and tomato yield has averaged 37% more for the areas rotated in sod regularly. With sweet corn the sod rotation treatment has shown 64% less soil loss, 67% less water loss, and yields have averaged 46% higher. The sod rotation system which reduces the intensity of cultivation and provides regular organic matter additions to the soil is an essential part of the conservation program on all cultivated land. A complete conservation program involves the combination of these soil management practices with mechanical practices such as contouring, terracing, strip cropping or other practices depending on characteristics of the land under treatment. The maintenance of good structure in the soil itself, however, is essential in all cases. The same soil treatments which contribute to conservation of soil and water usually bring about marked increases in yield of cultivated crops, as shown above." (O. R. Neal, New Brunswick, New Jersey.)

Oklahoma's Soil Conservation Contests - Harley A. Daniel, Guthrie, Oklahoma.-"Recognizing experience as the best teacher, soil conservationists have worked out a contest system of teaching soil conservation. Its purpose is to stress the importance of putting each piece of land to the use for which it is best suited, and treating it according to its needs for controlling erosion and improving fertility. In fact, all the practices and treatments necessary for developing and maintaining a permanent agriculture are emphasized.

"This contest didn't happen over night. It took several years to develop, and originated in 1941 at the Red Plains Conservation Experiment Station, Guthrie, Oklahoma. Many people have worked with the station staff in the development of the present contest. A large amount of credit goes to Edd Roberts, Extension Soil Conservationist, OAMC, and Sam Lowe, District Conservationist, SCS. Since it was perfected into its present form, Roberts and SCS personnel have held 76 soil conservation contests in Oklahoma, with more than 15,000 adult farmers, 4-H Club members and FFA youth competing. They were conducted in cooperation with the Soil Conservation District program."

Wind Erosion and Strip Cropping - Torlief S. Aasheim, Havre, Montana.-"There were several days of high wind during the month. For the 24-hour period from 8 A.M. November 26 to 8 A.M. November 27 the average hourly wind velocity at the North Montana Branch Station as recorded on the ten-foot anemometer was 30.5 miles per hour. For the succeeding 24-hour period the average wind velocity was 32.8 miles per hour at the same elevation. This two-day storm period caused little soil movement on fallow plots or fallow strips at the North Montana Branch Station but extensive soil drifting took place in the surrounding community. On one strip

cropped field which was observed on November 28 sand dunes up to three feet in height had accumulated along the west end of the stubble strip. The height of the sand dunes in this field depended on the height of the Russian thistles along the edge of the strip. In addition to the dunes along the edge of the stubble strip the eight-inch stubble was in many places nearly level full half way across the 10-rod strips. On large areas of the fallow strips the soil was removed to the depth of cultivation, the field appeared to have been cultivated about three or four inches deep. While this damage took place on a strip cropped field in ten-rod strips running north and south, most of the soil drifting took place on block fallow or strips running east and west. Block fallow, even though protected by a good cover of stubble mulch, was drifting on some fields observed. Observations made agreed with those which have been previously made that neither strip cropping nor stubble mulch tillage are sufficient by themselves to effectively control wind erosion in this area at all times."

Potato Harvester Completed - John W. Slosser, Orono, Maine.-

"Final tests of the harvester were made October 5-8. Prior to these tests, a stone trap had been devised and installed on the machine. The use of the stone trap permitted nearly continuous operation of the harvester since only infrequent stops were necessary after installation to clear the carrier of lodged stones. The stone trap also reduced the loss of tubers at the end of the row to a minimum. Temporary stone guards were also applied at the forward end of the digger which further reduced the number of clearing stops necessary. The machine is now considered satisfactory for release to a manufacturer without further design changes."

A Promising Method for Stabilizing Active Sand Dunes - A. W.

Zingg, Manhattan, Kansas.-"Further information on the value of petroleum asphalt-in-water emulsion to control soil erosion by wind was obtained. The emulsion sprayed on the surface of dune sand at the rate of 50 gallons per acre produced a film that was completely effective in holding the sand against high winds in the field. Two months after the application, the film was still quite effective in holding the soil, although some disintegration had occurred. Removal of sand was slight compared to that on a non-treated area.

"The film was quite porous and allowed water to enter the soil freely. In greenhouse tests, the emulsion appeared to have had no detrimental effect on crop growth.

"The method at present appears to be very promising for stabilizing active dunes. It is considerably less expensive than the old method of covering the surface with brush, listing, or planting to grass."

Sandy Land Problems in Nebraska - F. L. Duley, Lincoln, Nebraska.-

"It was reported last month that the supervisors of the Pierce County Soil Conservation District have offered to provide land for further studies that we have started on the sandy land in that part of the state.

"At a recent meeting at Pierce of representatives of the College, the County Agent, Soil Conservation Service-Research and Operations, and the Soil Conservation Supervisors, the proposal was further discussed. The supervisors plan to locate a few possible places where this work may be done, and from which a suitable location may be selected. It will then be decided

whether sufficient funds can be found to start any work of this sort during next spring. The need for more information on these sandy soils is widely recognized and the possibilities of obtaining worth while results are shown by a considerable number of preliminary tests. For example, one farmer produced 32 bu. per acre on untreated sand and 51 bu. following rye and vetch. This farmer grew 230 bu. of a rye vetch mixture on 15 acres. He sold his entire crop this fall for seeding on sandy land in that region.

"The problems involve wind erosion control, soil fertility, production of legumes and grasses, the use of fertilizers, lime and possibly other minor elements. An increase in our experimental work on these problems should yield valuable results within a reasonable time."

Effect of Cultivation on Soil Structure of Austin Clay Profile - J. R. Johnston, Temple, Texas.- "Water stable aggregation of a cultivated and a non-cultivated soil has been determined, the data are shown in the following table. Study of these data reveal some interesting points: (1) The surface layers of the non-cultivated soil has a very high proportion of water stable aggregates greater than 2 mm; (2) the cultivated profile is a structureless, incoherent mass showing no difference in structure throughout the entire 3-foot section; (3) and the portion of soil passing through the 0.2 mm screen does not vary greatly between profiles nor profile depths.

"Study of these profiles insofar as organic matter content and permeability are under way. After these data are obtained a more complete study of the profile characteristics can be made and related to moisture conservation and erosion control in Blackland soils.

Soil Treatment	Soil Depth Inches	Percentage aggregates by size				
		2 mm	1-2 mm	.5-1 mm	.2-.5 mm	.2 mm
70 years cultivation	0-6	35.93	30.96	14.47	8.15	10.47
	6-12	34.90	31.41	14.98	8.31	10.37
	12-18	33.90	35.04	15.91	7.18	7.93
	18-24	31.94	34.31	17.51	7.81	8.41
	24-30	33.39	34.03	16.33	8.08	8.14
	30-36	34.09	30.46	17.75	8.69	8.99
non cultivated	0-6	69.85	13.55	5.50	3.39	7.68
	6-12	56.60	26.14	8.20	3.91	5.11
	12-18	41.46	33.17	12.56	6.35	6.42
	18-24	32.90	33.55	17.83	8.44	7.23
	24-30	25.63	34.17	21.87	10.28	8.02
	30-36	24.43	33.27	23.68	10.54	8.05

* Water stable aggregates following a 30-minute soaking period and 60-minutes washing in aggregate analysis apparatus.

Some Effects of Organic Matter - C. S. Slater, Beltsville, Md.-

"The general term, organic matter, as applied to soil is being broken down gradually to more specific classifications for which specific effects have been noted. For example, the non-wettability of certain Florida soils has been traced to the presence of magnesium-organic compounds that are similar to lime and magnesium precipitated soaps. Thus, both cause and effect are related chemically to the trade-named commercial product, Vinsol, that is used to render soils water resistant.

"Another specific effect for a specific organic matter was determined in Michigan, where it was found that methylated cellulose applied to the soil lowered the water requirements of plants grown thereon, and improved their drouth resistance. Because excess water in plant tissue increases the liability of damage by frost, I believe that the results obtained in Michigan have a bearing on an effect that we have noted at Beltsville this fall, where it seemed that applications of organic matter had given a degree of frost hardness to young clover plants.

"A number of barrels of sub-soil were surface worked, limed and fertilized this fall and planted with ladino and Crimson clover. The soil was notably lacking in organic matter except for additions made during the experiment. After a number of sharp frosts when the plants were about four inches high, the barrels could be separated into groups on the basis of frost injury and previous organic matter applications as follows:

Organic Matter Treatment	Degree of Frost Injury
None at any time	Severe
Light leaf litter applied 2 years ago	Moderately severe
Some manure, & crop residues returned over a period of 2 years	Moderate
Soil mulched during previous winter and summer	Mild
Soil mulched heavily for two preceding years	None

Farmers Want Fish in the Farm Pond - John Lamb, Jr., Ithaca, N. Y.
(October Report) - "In the last two years the Allegany and Steuben County Conservation Districts have made fish available from the Fish and Wildlife Service and the New York State Conservation Department to about 150 farmers. These fish have been furnished to stock the farm ponds constructed in accordance with the recommendations of the individual soil conservation districts. The fish have been shipped to a central point and notices sent to all the farmers concerned as to when and where to pick up their fish. It is interesting to note that of the 150 notices there has not been a single failure to report for the fish. This in itself would appear to be an indication that there is considerable interest in the production of fish in farm ponds. Whenever the farmers have reported for fish there have been handed out instruction sheets on the proper methods of management of the ponds and fertilization of same.

"Farm ponds stocked with fish since 1946 are now producing several hundred pounds of edible fish per acre per year. 16" trout, 14" large mouth bass and 9" bluegills have been caught from the earliest stocked ponds. For best results good farm fish pond management is as essential as good soil management. (Robert A. Reed, District Conservationist)"

Corn Yields and the Drought - "There is no doubt in anyone's mind but that drought conditions existed over much of New York State last summer, but carefully measured yields of over 100 bushels per acre of shelled corn on plots at Marcellus and on others just north of Ithaca make one wonder whether the corn plants were fully aware of the situation. At Marcellus, a calculated daily balance of soil moisture based on Thornthwaites method of calculating potential evapotranspiration indicated that for most of the time after the middle of June until the end of August, available moisture was near or below the deficit line based on 4 inches of storage. The corn at Marcellus on good seedbed showed no visible effect of moisture deficiency until August. There was a fair amount of rainfall at both Marcellus and Ithaca, but distribution was poor as the following tabulation shows:

	Marcellus	Ithaca
	Inches	Inches
June 1-15	0.00	0.00
June 16-30	2.71	1.96
July 1-15	0.75	0.81
July 16-31	2.53	2.26
August 1-15	0.35	0.37
August 16-31	2.92	3.18
Totals	9.26	8.58

"It is apparent that the calculation of moisture deficits by the method used is not apt to be very satisfactory for annual crops. The data for potential evapotranspiration is based on a full growing cover. With an annual crop, losses would be less than calculated during the period of seedbed preparation, planting, and early growth.

"Temperatures were above normal during the whole summer, and apparently the corn responded well with only fair amounts of moisture. It would be interesting to know what yields would have been with supplemental irrigation.

"Hay yields also were at a high level at Marcellus, Wheat yielded very well, but oats were very poor. (George R. Free)."

What is 2 Inches of Soil Worth?- "First of all, we want it definitely understood that we don't know the answer, but a by-product of limited work at Marcellus last summer provides some food for thought. The removal of the top 2 inches of sod on an eroded slope decreased corn yields from 91 to 22 bushels per acre. The corresponding comparison on down the slope but in the same field where there had been some deposition in the past was 90.8 and 91.7. We cannot emphasize too strongly that this was not a replicated experiment, but the contrast is so marked that some discussion is warranted. The lower area apparently had a reserve of soil depth, fertility and structure sufficiently great that the removal of the 2 inches meant nothing. The

removal of the same depth on the slope meant practically a crop failure. Most of the station is more like the latter area than the former. It is interesting to note that this difference in yields occurred without any apparent difference in runoff during the year because the corn was contoured and there were exceptionally few erosive rains.

"We are approaching a time when some land leveling in this area is a definite possibility, and the problem of rebuilding desurfaced areas will become a real one. There should be some preliminary research work on the problem. What data there are would seem to indicate that yields of cultivated crops can be stepped up faster than resistance to runoff and erosion. (G. R. Free)"

Potato Irrigation - Fertilizer - Spacing Study - "This is the second year for this study on the same plot and covers 3 water levels, 3 planting distances, and 2 fertilizer rates. In order to cut down hand labor and increase the efficient use of farm machinery, rows were put in on 21" centers and seed pieces 6-2/3, 10 and 20" in the row. This did not change the number of plants per plot from that of the 1948 setup with rows on 12, 18 and 36" centers and seed pieces 12" in the row.

"Planting was started and completed May 12; harvest begun October 4 and completed October 13.

"Rainfall for the period was only 3" below the 14 year average. However, the plant growth on the rain only plots indicated a decided need for water during the June and July drouth periods. Statistical analysis of the data indicated that water application was highly significant, row spacings were not quite significant and fertilizer rates showed no significant differences. (E. A. Engdahl).

The Average of Potato Yields for Three Water Levels,
Three Planting Distances, and Two Fertilizer Rates.
Yields in Bushels per Acre (Essex Variety, above 2" size)

Water Source	1/2 ton ea. 5-10-10, 5-10-15			1 ton ea. 5-10-10, 5-10-15			Gen. Avg.
	6-2/3"	10"	20"	6-2/3"	10"	20"	
Rain only = 19.1"	355	352	292	287	314	249	308
Rain/ 5.7" = 24.8"	447	454	424	417	489	450	447
Rain/ 11.5" = 30.6"	524	470	388	415	554	483	472

Irrigation Not a Substitute for Good Soil Condition - "It was interesting to note that potatoes after potatoes at the Arnot, with a seed piece spacing of 3 sq. ft. and 5.7" of water applied yielded 424 bushels per acre. A field near by with slightly deeper soil, in sod for many years, with the same spacing and approximately 3" of water yielded 892 bushels per acre. The variety was Essex in both fields. The sod ground remained loose and friable while the potato ground compacted. Another variety, Kennebec, after sod made a yield of 981 bushels per acre (John Lamb, Jr.)"

Method of Seedbed Preparation & Corn Yields at Marcellus - "In our progress report for June we reported that 'come-up' of corn on the disked and sub-surface plowed seedbeds was very poor under the drouth conditions which prevailed then. Data on yield and stand at harvest time showed that both

were significantly greater on the turn plowed plots than on the disked and subsurface plowed plots. The average yield of corn on the turn plowed plots was 92 bushels per acre (56 pound bushels of shelled corn at 15% moisture) with some plots yielding 102 bushels per acre. Average yields on the disked and subsurface plowed seedbeds were 62 and 60 bushels per acre. These lower yields were partly but not entirely due to less stand. On the disked and subsurface plowed seedbeds, yields were significantly greater where a rye grass cover crop had been grown in the corn 4 years ago than where it had not. This did not show up on the plowed plots. (G. R. Free)."

Corn on Ridged and Flat Rows - C. S. Britt, Beltsville, Maryland.-

"During the past summer nine plots of ridged and flat cultivated corn were compared. There were no significant differences in corn yields under the two treatments during the past season which was very dry. In two previous comparisons of this type under different rainfall conditions, ridged plantings have outyielded flat plantings of corn. Since this is the first time ridged rows have not given better yields than flat rows, some details of management and rainfall are given below.

"The hybrid corn was an early maturing (90 days) variety in order to allow early harvest and fall planting of cover crops. The corn was planted in early June and only light uniformly distributed rains occurred during the three months following planting. The rainfall was 5.28 inches less than normal during June, July and August as show in the following table:

Rainfall for four month period at Beltsville, Md. compared with 35-year normal at College Park, Md.

Month	College Park, Md. 35-year normal	Beltsville, Md. actual	Departure from normal
June	4.02	1.35	- 2.67
July	3.92	2.30	- 1.62
August	4.41	3.42	- .99
September	3.21	3.80	+ .59

"The ridged corn grew faster throughout the season and appeared to be more mature when very adequate rainfall came in September. The ridged corn was apparently too mature to be benefited by these late rains, whereas the flat corn derived some benefit because of slightly delayed maturity.

"The yields of corn were unusually high considering the dry season. The average yield for 8 plots following two years of Ladino clover-orchard grass was 60.8 bushels per acre. In another field 8 plots following good stands of rye-vetch yielded 49.8 bushels of corn per acre. The rye-vetch top growth amounted to 1-1/2 tons dry weight when turned under May 6, one month before planting the corn.

Corn Yields in Relation to Cropping Systems and Fertilizer - D. D. Smith, Columbia, Missouri. - "Corn yields during 1949 were affected by the cropping system as well as by the fertility treatments. Second-year corn again yielded approximately one-half that of first-year corn. Sweet clover under as green manure was more effective than the previous year's growth of lespedeza. An additional 100 pounds of ammonium nitrate on meadow sod plowed for corn was more effective than sweet clover as green manure. Yields of corn for these comparisons were as follows:

<u>Rotation</u>	<u>Treatment plowed under</u>	<u>Bu./Acre 1949 Yield</u>
Corn-oats	Oat stubble	21
Corn-oats and lespedeza	1948 lespedeza crop 200 lb./acre ammonium nitrate*	78
Corn-oats and sweet clover	New growth sweet clover 200 lbs./acre ammonium nitrate*	100
Corn-corn-oats- wheat & sw. clover	New growth sweet clover 200 lbs./acre ammonium nitrate*	100
Corn-corn-oats- wheat & sw. clover	Corn stalks 200 lbs./acre ammonium nitrate*	62
Corn-wheat-meadow- meadow	New meadow growth 200 lbs./acre ammonium nitrate*	107

* 300 lbs./acre 5-10-10 starter
also, 1000 lbs./acre rock phosphate as base treatment, as well as lime.

Soybean Yield in Relation to Topsoil Depth - "Soybean yields were not increased during 1949 by the plowing under of 100 lbs./acre of ammonium nitrate. Also, additions of 16 or 32 pounds of nitrogen per acre to starter fertilizer equivalent to 100 lbs./acre of 0-32-32 did not significantly increase soybean yields. Soil depth affected soybean yield even though high fertilizer treatments were used.

<u>Depth of surface soil</u>	<u>Yield</u>
10 inches	32.8 bu./acre
8 inches	31.9 bu./acre
4 inches	26.6 bu./acre

Corn and Oat Yields in Relation to Land Class and Erosion - B. H. Hendrickson, Watkinsville, Georgia. - "We have some data on yields of corn and oats, including the 1949 yields, that shed some light on the question as to what extent croplands are damaged by different degrees of past erosion.

"Mr. William E. Adams reports that hybrid corn grown on Classes II, III, and IV land (with 8, 5, and 2" topsoil) averaged in yield for the 1947-49 3-year period 3,670, 2,902 and 2,103 pounds per acre of grain, respectively. The rounded figures in bushels per acre in the same order are 65, 52, and 38. For the prior 1943-46 4-year period, corresponding averages for open-pollinated corn then being grown in the same rotation were 32, 24 and 18 bushels per acre. During both periods, the corn always followed a turned-under green manuring crop of vetch.

"Two principal factors are involved, (1) greater productive capability of the hybrid corn, and (2) increased rate of fertilization for the hybrid corn.

"The range of the differences in bushels per acre yields, - 33, 28, and 20, - also reflect the 'permanent damage' to the land caused by past erosion. At any rate, it was 'long-lasting damage.'

"Oats, grown in the same rotation, during the latter 3-year period averaged 2,260, 2175, and 1450 pounds per acre of grain, respectively, or, in rough figures 71, 68, and 45 bushels per acre. Differences over the average oat yields for the previous period were but 8, 10, and 2 bushels per acre. Oats always followed cotton and there was no change in fertilization rate for the oats.

"We can say that oat yields were not affected by slight erosion, but the yields were seriously limited on the very thin topsoil Class IV land.

"The 3-year rotation consisted of oats-lespedeza for grain and seed, cotton, vetch for green manure and corn. The soil improvement crops consisted of one year's growth of lespedeza with its full residues turned under, and 1 crop of vetch for green manure, per cycle. The rotations also contained 2 years of row crops out of 3, - obviously too many for reasonable Class IV land application, but fairly satisfactory as a conservation-type rotation on Class II land.

"A cheerful fact is that all yields, including cotton and vetch, trended upwards throughout the 7 year period.

"We can conclude that every inch of topsoil lost reduces the yields of corn, and most seriously of both corn and oats when the original topsoil was more than one-half gone. It is also obvious that stronger protective and soil improving conservation-type rotations are needed on the thinner, more erodible croplands, from the sole standpoint of yield returns.

"A total of 27 experimental plots were involved in this study - a triplicated setup on Cecil soils - 3 each for each crop year on each of the 3 land classes.

Supplemental Irrigation of Cotton - "Mr. John R. Carreker reports as follows: 'Cotton was grown in 1949 following lespedeza in rotation on Class III upland. A series of 4 plots were irrigated during dry spells on July 5th and July 19th, and given a 1-1/2" irrigation each time. A second series of 4 check plots, were not irrigated. The seed cotton yield increase due to irrigation amounted to 11.2 percent or 130 pounds per acre, the difference between 1285 and 1415 pounds per acre. There was rather rank vegetative growth on all cotton grown on improved cropland in 1949, due to favorable rainfall. Very heavy boll weevil infestation was general, and apparently not related to irrigation applications in this test. The value of the increased yield of cotton in 1949, was not enough to justify the costs of the supplemental irrigation given.

"In the 1st trials in 1948, better than a 50 percent increase due to irrigation did justify the expense of applying the water."

Wind Erosion Studies - C. J. Whitfield, Amarillo, Texas.-"Wind tunnel tests were made on selected plots at the Amarillo station by Zingg and Woodruff, of the Manhattan Wind Tunnel Project, assisted by station personnel during the period of November 8-14, inclusive.

"Seven plots were tested with three tunnel sets on each. This made a total of 21 tests. Each test was made according to a pre-determined procedure. Briefly, this procedure consisted of increasing the force of the wind progressively. After the application of a force for a period of time sufficient for soil movement to cease, the amount of loss as collected by the sampler was determined.

"Soil samples were collected from each plot for the determination of clod structure by rotary sieving. A total of about 500 soil samples were collected and weighed. To secure a measure of the variation, 6 samples were sieved from each plot. Preliminary consideration of the results of the sieving do not indicate marked differences in the conditions observed on different plots. The soil from the continuous sorghum plots appears, however, to contain a larger percent of erodible fraction than any of the other plots.

"Residue determinations were made on all plots tested.

"To summarize, plots on the station appear to be in a very favorable condition to resist movement by wind at the present time. Measured differences in susceptibility to erosion appear to be primarily due to the amount and nature of surface residues present rather than to characteristics of the soil itself.

"Residue conditions on the various plots tested were as follows:

Rotation	Present Condition	Nature of Residue and Quantity in Lbs./Acre
Wheat-sorghum-fallow-grass (plowed out of grass in 1948)	Subtilled stubble from 1949 wheat crop	2800 wheat stubble
Wheat-sorghum-fallow	20" sorghum stubble in 40" rows remaining from 1949 crop	5500 sorghum stubble and leaves
Wheat-sorghum-fallow-grass	Planted to wheat, last crop sorghum in 1948 cultivation by sub tillage	430 sorghum residue, 2100 green wheat
Continuous wheat	Planted to wheat, cultivation made by oneway plow	565 wheat stubble 510 green wheat
Continuous sorghum	20" stubble in 40" rows remaining from 1949 crop	5200 sorghum stubble and leaves
Sorghum in 1947 and 1948, fallow in 1949	In fallow with small amount of residue	1100 sorghum residue

Stubble Mulch Studies - "During each of the eight years that stubble mulch studies have been carried on at the Amarillo station, it has been observed that the ratio of weight of straw to weight of grain of the wheat crop has been consistently less where sub tillage was practiced than where either the oneway or moldboard plow was used. Soil studies, as well as chemical analyses of wheat forage and grain, have indicated that this relationship is, at least in part, due to retarded growth in early spring caused by depressed nitrification under the stubble mulch. Some writers, however, have suggested that a low straw-grain ratio may also be due to a high level of available phosphorus in the soil, the function of phosphorus being to counteract the effect of excessive nitrogen^{1/}. To test this hypothesis, soluble phosphorus tests of the top three inches of soil from some of the stubble mulch plots were made during the past month (See following table).

Mean Soluble Phosphorus Content of Top 3 Inches of Soil
From Stubble Mulch Plots

Tillage	Soluble Phosphorus	
	ppm. P	
Continuous wheat		
Moldboard plow		5.0
Oneway		6.2
Subtillage		6.1
Wheat-fallow-wheat		
Oneway		5.6
Subtillage		6.1

"Soluble phosphorus determinations made at approximately 100 additional locations over the Amarillo station have given amounts of soluble phosphorus ranging from 3 to 13 ppm. of P. In view of this variability, any differences due to methods of cultivation appear to be trivial.

^{1/}. Lyon, T. L., and Buckman, H. O. "The Nature of Property of Soils."
The MacMillan Co., New York, 1947, pp. 402."

Effects of Rate of Grazing Pastures - O. K. Barnes, Laramie, Wyoming.-"The grazing and utilization records from the rate of use pastures are summarized in this report. Vegetative and root studies were summarized in monthly reports dated August and September, 1949.

"The plan of this study has been to graze the same pastures each year until the shortgrass had a predetermined height left, and approximately the same height each year, rather than following a predetermined percentage use of the current forage. This was due to the fact that many smaller operators pay closer attention to heights left than they do to percent used and that it is rather common to graze the range to the same degree each year. The amount of supplemental feed varies with the years. In good years the animals are kept on the range until use reaches what the operator believes proper. In dry years this degree of use is reached earlier and the feeding of hay or use of stubble fields, etc. is started earlier.

"Duplicate pastures are used for each of the three degrees of forage removal. The six-year average for the heaviest rate shows that we have left .63 inches of leaf on blue grama and buffalograss each year. The light rate left 1.11 inch and the moderate rate .85 inch. The next most important species, western wheatgrass, had 2.14, 3.33 and 4.58 inches of leaf left on the heavy, moderate and light rates of use. In terms of volume of residue left each year the six-year average shows 140 lbs. per acre on the heavily used pastures, 356 lbs. on the light, and 236 lbs. per acre on the moderate rate of use. This difference in carry-over vegetation is 2.5 times greater on the light used pastures than on the heavily used pastures.

"Clipping studies for current yields of forage from randomized plots within these pastures show negligible differences in perennial grass production between these three rates as yet.

"The grazing rates and animal gains are shown in Table II. To date the principal difference in animal gain comes with the ewes. The six-year average shows that the ewes on light and moderate use pastures have gained one-third more than those on the heavily used pastures. The lamb gains show little difference between pastures. The six-year average shows about a 3 lb. per head advantage on light and moderate use over the heavy rate of use.

"As reported previously, studies in 1949 show a gradual change occurring in the vegetation. Under the heavy rate for five years there is a shift from fewer midgrasses to more shortgrass in the cover.

"Marked differences and changes are still not too evident between these pastures. It is apparent that this range type is very resistant to grazing with sheep. The fact that sheep prefer the more resistant shortgrasses to midgrasses and that forbs rate high in their diet undoubtedly enters into these results as compared to results obtained on cattle ranges elsewhere.

Table 1.--Amount of Grass Left Each Year at End of Grazing Season in Pounds per acre and Leaf Height

	Grass Left at End of Grazing Season (Lbs. per Acre)			Av. Leaf Height at End of Grazing Season	
	Blue Grama and Buffalograss	All other Perennial grass	Total	Blue Grama and Buffalograss	Western Wheatgrass
Light Use 1949 (Sixth Year)	232 lbs.	116 lbs.	348 lbs.	1.34 in.	4.82 in.
6 Yr. Average	213	143	356	1.11	4.58
Moderate Use 1949 (Sixth year)	135	99	234	1.05	3.60
6 Yr. Average	165	71	236	.85	3.33
Heavy Use 1949 (Sixth Year)	128	61	189	.75	1.48
6 Yr. Average	104	36	140	.63	2.14

Table 2.--Stocking Rates and Animal Gains from Three Intensities of Forage Removal.

	Sheep Days Grazing Per Acre	Gain per Head		Gain per Acre	
		Ewes	Lambs	Ewes	Lambs
		Lbs.	Lbs.	Lbs.	Lbs.
Light Use 1949 (Sixth Year)	36	24.3	45.3	7.7	18.0
6 Yr. Average (1944-1949)	34	24.8	45.6	7.8	15.8
Moderate Use 1949 (Sixth Year)	58	23.2	49.6	12.0	31.7
6 Yr. Average (1944-1949)	57	24.3	45.7	12.1	25.4
Heavy Use 1949 (Sixth year)	78	18.0	46.3	12.4	40.0
6 Yr. Average (1944-1949)	82	16.4	43.0	11.2	34.3

Crop Yields in Relation to Different Cropping Systems - Frank W. Schaller, Ames, Iowa-"Progress has been made in the summarization of field data obtained during 1949. Corn, oats and hay yields from the control plots (Experiments I and II) at Clarinda are reported in Table 3. The highest average corn yields (97.3 bushels) were obtained on the plots which have now been in a C-O-M rotation for seventeen years. Plots which were changed to a C-O-M rotation after ten years of continuous corn (1932-1942) are continuing to improve and this year produced only 15 bushels per acre less than the plots in rotation for seventeen years.. Ten years of alfalfa or Kentucky bluegrass is still producing a marked residual effect on corn yields. Corn has now been grown for seven consecutive years after breaking these sods. Alfalfa has been more effective in maintaining the yields than bluegrass. The yields this year average 68.1 and 57.8 bushels per acre, respectively, for the plots previously in alfalfa and bluegrass. Plots which have been in continuous corn for seventeen years averaged 23.2 bushels per acre in 1949.

"All oat yields at Clarinda were very low this year. The best treatment on the control plots, which was a C-O-M rotation from 1932 to 1949, averaged only 20 bushels per acre.

"The residual effect of ten years continuous corn is not apparent in hay yields on the control plots. This would seem to indicate that nitrogen soon becomes limited after several years of continuous corn and, although it seriously reduces corn and oat yields, it has little or no effect on alfalfa production.

Table 3.--The Effect of Cropping Systems on Yield of Corn, Oats and Hay, Marshall Silt Loam, Clarinda, Iowa (Experiment I & II)

Plot No.	Cropping System	Yields		
		Exp. I	Exp. II	Ave.
	<u>CORN (BU./A)</u>			
2	Corn, 1932-42; rotation C-O-M 1943-49	98.83	66.43	82.6
*U-2	Corn, 1932-49	27.33	19.16	23.2
5	Rotation C-O-M 1932-49	105.22	89.45	97.3
7	Alfalfa 1932-42; Corn 1943-49	80.10	56.20	68.1
8	Bluegrass 1932-42; Corn 1943-49	73.38	42.31	57.8
	<u>**OATS (BU./A)</u>			
3	Corn 1932-42, C-O-M 1943-49	11.60	12.31	11.9
6	C-O-M 1932-49	21.19	18.82	20.0
9	Desurfaced, Corn 1932-42; C-O-M 1943-49	11.01	4.85	7.9
	<u>HAY (T/A)</u>			
1	Corn 1932-42; C-O-M 1943-49	3.14	2.99	3.1
4	C-O-M 1932-49	2.85	2.84	2.8

* Lower hill of each row not harvested.

** Considerable damage to all plots by rodents and birds.

Table 3a. Corn Stands

Plot No.	Cropping System	Stand (Plants/A)		
		Exp. I	Exp. II	Ave.
2	Corn, 1932-42, Rotation C-O-M 1943-49	12,500	9,942	11,221
U-2	Corn, 1931-49	12,309	10,641	11,475
5	Rotation C-O-M 1932-48	12,600	10,914	11,757
7	Alfalfa 1932-42; Corn 1942-49	12,100	10,399	11,249
8	Bluegrass 1932-42; Corn 1943-49	12,600	10,628	11,614

Effect of Crop Rotations on the Yield of Corn - "The effect of crop rotations on the yield of corn on Marshall silt loam for 1949 is presented in Table 4. The data show that for nearly all rotations there is a wide variation between replications. This variation is greater than in past years and is believed due at least in part to the serious grasshopper damage on many of the meadow plots during 1948. The destruction of legume stands was undoubtedly responsible for much of the nitrogen deficiency which was evident on many plots this year. The grasshopper damage is also believed to be an important contributing factor to the low yields of first-year corn as compared to second-year corn.

"The most important effect on corn yields in the rotation study this year appears to be that which resulted from applying manure to second-year corn. In Rotation IX it is seen that the yield of second-year corn with manure is very uniform for the three replications and averaged 25 bushels per acre more than first-year corn.

Table 4.--The effect of crop rotations on the yield of corn, Marshall silt loam, Clarinda, Iowa (Experiment IX).

Plot No.	Rotation	Cropping System	Yield - Bu/A			
			Block A	Block B	Block C	Ave.
21, 42, 94	II	Corn, oats (SwCl for green manure)	65.03	46.74	78.02	63.26
7, 49, 67	*III	Corn, oats	66.79	65.87	52.42	61.69
	IV	Corn, corn, oats (SwCl for green manure)				
12, 41, 82		First-year corn	54.50	59.10	68.39	60.66
28, 33, 93		Second-year corn	78.42	98.33	69.86	82.20
24, 52, 73	V	Corn, oats, meadow	75.33	79.03	59.07	71.14
30, 62, 84	VI	Corn, oats, meadow, meadow	89.38	80.87	95.73	88.66
	VII	Corn, corn, oats, meadow				
26, 50, 83		First-year corn	96.47	115.95	62.76	91.73
9, 47, 78		Second-year corn	106.32	97.96	84.46	97.25
	VIII	Corn, corn, oats, meadow, meadow				
1, 60, 80		First-year corn	129.79	60.91	102.42	97.71
10, 57, 87		Second-year corn	113.59	76.83	91.15	93.86
	* IX	Corn, corn, oats, meadow (manure on 2nd-year corn)				
15, 35, 85		First-year corn	88.03	97.23	47.88	77.71
27, 43, 66		Second-year corn	102.80	101.23	105.07	103.03
	X	Corn, oats (SwCl), corn, oats, meadow				
17, 46, 65		Corn after meadow	64.46	49.61	72.55	62.21
19, 51, 81		Corn after SwClover	65.09	66.24	66.34	65.89

* The following changes were made in rotations in 1948. These changes seemed advisable since rabbits had each year destroyed the soybeans grown in small plots.

Rotation I (cont. corn) and X (C-C-SB-O_{scl}) changed to a C-O-M-C-O_{scl} rotation.

Rotation III (C-SB) changed to a C-O rotation.

Rotation IX (C-SB-O-M) changed to a C-C-O-M and 8 T/A manure on 2nd-year corn.

LSD = 28 Bu.

Soil and Water Loss from Different Cropping Systems, Marshall Silt Loam, Clarinda, Iowa. -"The effect of cropping systems on runoff and soil loss is shown in Table I. It is to be seen that during the first 10-years of the experiment runoff from continuous corn was highest and averaged 18.7% of the total precipitation. The runoff averaged 12.6% for rotation corn, 9.9% for oats, and was very low for the close growing sod crops. Under a continuous bluegrass sod the runoff was lowest and averaged 1.2%.

"For the same 10-year period soil loss from continuous corn was about twice that from corn grown in rotation. The soil loss from oats was about one-half that from rotation corn. From the close growing sod crops erosion was negligible.

"Average soil and water losses from five years of corn (1943-48) following eleven years of alfalfa or bluegrass are somewhat lower than those from rotation corn. This would indicate that there was a residual protective effect from these sod crops. A study of the yearly soil and water losses shows that this effect was greatest in the first three years after breaking the sod. In 1947 and 1948, which were fifth and sixth year corn after sod, the runoff and soil loss was equal or higher than that from rotation corn.

"The effect of establishing a rotation of corn, oats and meadow after eleven years of continuous corn on soil and water losses is presented in Table II. After approximately two rounds of the three-year rotation, soil and water losses are now about the same as that occurring on plots which have been in a corn, oats, meadow rotation for sixteen years. It is also shown that establishing the rotation has reduced runoff to less than one-half that from continuous corn. However, soil loss which has been relatively low during this period has been reduced only slightly.

Table I.--Soil losses and runoff from various cropping systems, marshall silt loam, Clarinda, Iowa (Experiment I & II)

Cropping System *	1933-42 Ave.		1943-48 Ave.	
	Soil Loss T/A	Runoff** %	Soil Loss T/A	Runoff %
Corn, 1933-48	38.3	18.7	-	-
Rotation Corn, 1933-48	18.4	12.6	8.5	4.8
Rotation Oats, 1933-48	10.1	9.9	1.4	2.1
Rotation Meadow, 1933-48	5.4	3.8	0.0	0.0
Ave. for C-O-M Rotation	11.3	8.8	3.3	2.3
Alfalfa 1933-42, Corn 1943-48	0.01	2.2	6.7	3.4
Bluegrass 1933-42, Corn 1943-48	0.03	1.2	5.2	4.1

* Corn listed on the contour in 1943; surface planted up and down hill in other years.

** Runoff is percentage of total precipitation. Average annual precipitation 1933-42 = 28.26 inches; 1943-48 = 31.87 inches. No rains occurred which caused runoff or soil loss in 1946.

Table II.--The effect of establishing a rotation of corn, oats, meadow after eleven years of continuous corn on soil and water losses from corn, Marshall silt loam, Clarinda, Iowa (Experiment I & II)

Cropping System	1933-42 Ave.		1947-48 Ave.	
	Soil Loss T/A	Runoff* %	Soil Loss T/A	Runoff %
Continuous corn, 1933-48	38.3	18.7	8.7	12.9
Rotation C-O-M, 1933-48	18.4	12.4	8.4	4.4
Corn 1933-42; Rotation C-O-M 1943-48	38.3	18.7	8.1	5.0

* Runoff in percentage of total precipitation.

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"The November rainfall totaled 1.28 inches - 46 percent of normal. Soil moisture and ground-water levels are very low. For the past 4 months there has been little opportunity for ground-water recharge. In fact, the soil-moisture trend has been downward as indicated by lysimeter records.

Month	Rainfall		Soil moisture change in 8-foot lysimeters	
	Normal	Actual	Corn to wheat	Grass
	Inches	Inches	Inches of water	
August	4.02	2.57	-2.38	-1.90
September	2.97	3.44	+1.31	- .14
October	2.49	.90	- .37	-1.65
November	2.75	1.28	+ .47	+ .57
Total	12.23	8.19	- .97	-3.12

"With normal rainfall in October and November there would have been about 3 inches more water in the 8-foot profile. The soil-moisture content of wheatland would have been at field capacity and recharge to ground water imminent. Soil moisture of grass and woodland would need more water to reach field capacity.

"Actually on November 30 moisture content of the 0 to 40-inch profile was 2-3/4 inches away from field capacity. In other words, the moisture content of this depth will have to be increased by 2-3/4 inches before there is a possibility of ground-water recharge. If we have normal precipitation for the next 2 months and all of it goes into the ground, the soil-moisture content will reach field capacity and ground-water recharge commence. This would make it late February or March before significant water reached the ground-water table. This is rather late. In 11 years of record, only once has this percolation started later than January. It normally stops in July or August and then starts again when soil moisture exceeds field capacity.

"A representative from the Hanna Coal Company, strip miners in eastern Ohio, inquired regarding soil-physical conditions in leveled spoil banks. We informed him of the need for research on this matter and explained our inability to make studies because of lack of funds."

Hydrologic Studies - R. W. Baird, Blacklands Experimental Watershed, Waco, Texas.-"During the month of November there was one rain of 0.23 inch, November 11, as compared to a normal of 2.69.

"Conservation farming paid off in increased cotton and corn yields over conventional farming methods. The Y area with conservation measures (including terracing, contour cultivation, and soil improving crops) produced an average yield of 186 pounds of lint cotton per acre and 36 bushels of corn per acre, in comparison to 118 pounds of cotton and 22 bushels of corn from the conventional system of farming practices on the W area. The W area has straight row farming with 50 percent of the area in cotton each year in a 4-year cropping system of cotton, corn, and oats without a soil improving crop.

"The pounds and percentage yield figures from the two areas were as follows:

"The conservation farming system gave an increase of 68 pounds of lint cotton per acre or 58 percent increase. The corn yield increase per acre was 14 bushels or 64 percent increase."

Hydrologic Studies - J. A. Allis, Central Great Plains Experimental Watershed.-"No precipitation was recorded in November, in fact no measurable precipitation has occurred since the 2.8 inches rain on October 10, making 51 days up to November 30, without precipitation. This is the longest period without moisture during the past 10 years on this project and probably the longest dry period on record in South Central Nebraska. The project is in Hartings, Nebraska.

"During the month a Progress Report for this project was varityped by the Regional Office. A wide distribution was made of this report, being sent to all SCS offices in the six States of this region, to the Washington office, and all Regional offices. Outside of the SCS this report was sent to the Nebraska and Kansas State Experiment Stations, Canada Experiment Station, and to others interested in the project, such as College and University instructors and others. Many complimentary letters have been received concerning this report and it is felt that we have been adequately repaid for the time and effort which was spent in the preparation of this paper."

Hydrologic Studies - R. B. Hickok, LaFayette, Indiana.-"Total rainfall in November was substantially below 'normal' (300 percent of normal, previous month with little runoff) storms totaling approximately 1.16 and 0.38, respectively, on the 12th and 13th, produced only slight runoff from a few of the experimental watersheds. It may be significant that what runoff occurred came from watersheds in meadow, permanent pasture, and woodlot, with none from watersheds from which corn had recently been harvested (stalks still standing).

"It has been our desire for several years that soil influences on the runoff and erosion from the watersheds should be carefully studied as a means of evaluating and projecting the results of their experimental treatment. Limited funds and personnel have made it necessary to hold much of the work planned along this line in abeyance in order to develop the direct measurement phases of the research. It is with considerable satisfaction that we are able at this time to report progress of fundamental soil physical studies of soils on the experimental watersheds, related to their runoff and erosion behavior.

"Mr. N. L. Stoltenberg of our Project Staff has compiled the following brief report of his recent work along this line:

"The following summarizes the results of some preliminary study of the physical characteristics of the soils on the watersheds on the Purdue-Throckmorton farm. These conclusions are limited to soil classified as Carrington silt loam (#24, Indiana Soil Survey legend) which is the dominant soil on the farm.

"It is increasingly evident that those soils have been formed from a thin mantle of loess, varying in thickness from a few inches to possibly a few feet. This overlays the glacial till which may vary considerably in character. In places the till is quite clayey and impermeable, in others relatively gravelly and permeable. The loess derived topsoil is well drained but the clayey till underlying much of the area has resulted in the profile being termed slowly drained. The soils resulting from this loess-till complex have

been influenced considerably in their formation by both parent materials. The processes of soil development have caused some mixing of these materials near the contact. The contact has been obliterated over a portion of the area by plowing and erosion but it is well defined at greater depth. Where plowing and erosion has cut into the contact, the surface soil will follow the variations of the underlying till.

The loose mantle improves the character of the soil. Protection of this thin mantle from erosion is especially important for once lost, no improvement in practices can bring it back.

Conclusions - Soil #24, Watersheds 14 and 15 - Note: Watersheds 14 and 15 contiguous, under conservation and prevailing treatment, respectively, since 1942. (All conclusions except #6 and #11 have statistical significance.)

1. Volume weight is slightly higher on Wsd. 14 than on Wsd. 15 at the three depths sampled. (Table 1)

Table 1

Depth	Volume weight at field capacity	
	Wsd. 14	Wsd. 15
2-5	1.41	1.36
8-11	1.38	1.34
14-17	1.42	1.39

2. Field capacity both by weight and by volume is slightly higher on Wsd. 15 than on Wsd. 14. (Table 2)

Table 2

Depth	Wsd. 14			Wsd. 15		
	F.C.	% Vol.	pF	F.C.	% Vol.	pF
2-5	35.3		1.9	37.0		1.9
8-11	36.0		1.8	37.0		2.1
14-17	35.2		1.9	37.0		2.0

3. pF at field capacity is quite variable, individual samples running from 1.7 to 2.9. pF at field capacity is greater on Wsd. 15 than on Wsd. 14. (Table 2)
4. Aeration porosity (% pore space drained at pF 1.7) increased with depth on Wsd. 14 but not on Wsd. 15. (Table 3)
5. Aeration porosity was not significantly different on the two watersheds at comparable depth (data from Wsd. 15 more variable) (Table 3). The deep rooted legumes in the conservation treatment on Wsd. 14 have had little effect.

Table 3

Depth	Aeration Porosity %*					
	Wsd. 14			Wsd. 15		
	Before plowing	3w after plowing	End corn season	Before plowing	3w after plowing	End corn season
2-5	3.3	---	10.8	4.0	---	9.7
8-11	4.3	5.6	5.5	3.2	5.2	6.2
14-17	5.0	5.2	---	4.0	5.4	---

* % Pore space drained at pF 1.7

6. Earthworm and root holes (each tends to follow the other) are the dominant cause of the aeration porosity at all depths.
7. Mean percolation rates on 3" x 3" cores on a porous porcelain plate using 1/4-inch head of water varied from 0.07 in./hr. to 0.21 in./hr. but significant differences between watersheds were not obtained.
8. Correlation between percolation rate and the macro pores drained at pF 1.7 was poor. Correlation was good when the percolation rate was compared with the pore space drained at 50 minutes at pF 1.7. This indicates the greater effectiveness of the largest pores (earth worm and root holes). Data obtained in the future will include measurements at pF 1.0 or 1.3.
9. The mean percolation rate of all samples taken below the plow layer was 0.12 inch per hour. It may be coincidental, but the minimum infiltration rates as determined from analyses of the 1942 and 1945 hydrographs from these watersheds ranged from 0.06 to 0.13 inch per hour.
10. A rather high aeration porosity was maintained in the plow layer, within 10 inches of the corn row. (Table 3.) The upper 6 inches near the row was much looser than in midrow.
11. There appears to be a small increase in the aeration porosity during the corn season at depths below the plow layer."

Hydrologic Studies - George A. Crabb, Jr., East Lansing, Mich.-"As measured by the U. S. Weather Bureau type of nonrecording rain gage, precipitation for the month of November amounted to 1.27 inches at the cultivated watersheds, 1.68 inches at the wooded watersheds, and 1.52 inches at the stubble-mulch plots. These amounts are approximately 51 percent, 68 percent, 61 percent of the 50-year average November precipitation of 2.48 inches. November precipitation can be expected to equal or exceed 1.27 inches once in 1.7 years. Cumulative rainfall for the year amounts to 30.14 inches, or 102.66 percent of the 29.36-inch normal. There were no runoffs during the month."

"Solar radiation for the month equaled a total of 4,004.6 gram-calories per second per square centimeter at the pyrliometric station located at the cultivated watersheds. This is approximately 128.29 percent of the 3,121.7 normal radiation to be expected here in November, and raises the annual cumulative amount of radiation received to 93,779.7 gram-calories, or 93.93 percent of the normal of 99,837.6 gram-calories cumulative.

Hydrologic Studies - T. W. Edminster, Blacksburg, Va.-"A large portion of the month was spent in reviewing and discussing several hydrology papers with Messrs. Holtan and Kirkpatrick. During this period, drafts of two publications were prepared: (1) 'Some Broad Phases of the Hydrology of Run-off' and (2) 'Hydrology of Runoff Applied to a Major Group of Virginia Piedmont Soils.' Both of these papers were reviewed in detail by Mr. R. C. Jones, Zone Engineer, Region 2, who spent several days at the project going over the calculations and methods of application of the hydrologic principles as set forth in these publications. Copies of these papers were forwarded to Mr. A. Carnes, Regional Engineer, for his comments prior to preparation of the final manuscript. These comments and the final manuscript have been completed for the first of the two manuscripts and this paper was submitted for clearance."

Farm Ponds - T. W. Edminster, Blacksburg, Va.--"Mr. Holtan has started the preparation of a manuscript on 'Sealing Farm Ponds' which is intended for subsequent publication as a TP. This manuscript is being prepared as a field manual for use by Operations personnel. It will be less technical than former papers that have or are in the process of publication."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minn.--"Considerable time has been spent during the past 2 months on the preparation of reports covering the studies made for the Whiting Naval Air Station near Milton, Fla. The report covering the cantilever outlet studies for C Ditch is ready for the typing of the final rough draft and the assembly of the illustrations. The report on the tests of the three models of transitions between the drainage pipes and open ditches has been roughed out and drawings have been prepared. The report on model tests of a detention structure for use in P Ditch has been roughed out as has the report on the ditch junction studies. Twenty-five man days were spent on this work."

Sedimentation Studies - Louis M. Glymph, Jr., Lincoln, Nebraska.--"In connection with the cooperative work with the Missouri State Conservation Commission and the University of Missouri on a sedimentation survey of Ashland Lake, near Columbia, I spent the period November 7-18 on this study. The Conservation Commission furnished a 4-man engineering survey party which worked under my supervision. In addition to the party, Mr. Roy Erickson, SCS Region 3, Flood Control Surveys, and Dr. Robert S. Campbell, of the University Wildlife Research Unit, spent full time on the job.

"I feel that we got a very good survey on this reservoir and have established the basis for future resurveys that will prove very valuable. Dr. Campbell plans to have his class of graduate students in fish management studies resurvey the reservoir each year. In order for us to get the full benefit from these annual measurements of sediment production from the watershed, I feel that arrangements should be made for installation of rain gages in the watershed, a water-stage recorder on the reservoir, and the maintenance of an annual record of land use and the kind and amount of conservation practices in use in the watershed. I want to give some more thought to procedures for collecting these additional records and will write more about them in the near future."

"I spent November 22 on the campus at Kansas State. There I found that Prof. Reed Morse, Head of the Civil Engineering Department, is planning to have a hydrology class of civil engineer seniors make a survey on nearby Elbo Lake next spring. I had discussed this possibility with Prof. Morse previously and am pleased by the interest he has developed in the subject. Here again is the prospect of annual or more frequent resurveys and the opportunity to associate measured rates of sediment production with causative factors. Dr. Myers and Dr. Fly, State Soil Scientist, have promised to make a conservation survey of the reservoir watershed. We will give some more thought to assembly of hydrology data on the watershed in further development of this study."

Supplemental Irrigation Studies - John R. Carreker, Athens, Georgia.--"Rainfall recorded in November was: November 1, 0.14 inch; 13, 0.16 inch, 24, 0.39 inch; and 29, 0.20 inch, totaling 0.89 inch. The 0.14 inch on the 1st was part of 0.74 inch that fell on October 30, 31, and November 1. Therefore, there was good soil moisture at the beginning of the month. Even though the rainfall was 2.02 inches below normal, the soil never became exceedingly dry."

"Evaporation was 2.36 inches and the wind movement totaled 1,076.3 miles.

"The low temperature recorded was 17 degrees November 23. Freezing temperatures were recorded on 20 days during the month.

"Cotton harvest was completed November 9 on the irrigation vs none plots at the Southern Piedmont Conservation Experiment Station. The yield averages from four plots with each treatment showed:

	Unirrigated	Irrigated	Increase with Irrigation
	Pounds	per acre of	seed cotton
First picking 10/3	902.5	860.0	-42.5
Second picking 11/9	252.2	425.5	+173.3
Total	1,154.7	1,285.5	130.8

"This 130.8 pounds or 11.3 percent increase in cotton yield was obtained during the most severe boll weevil infestation for the past 20 years. It was of especial interest that the effects of the irrigations of 1.5 inches each on July 5 and July 28 were not overcome by increased boll weevil activity in the plots receiving the extra water.

Drainage Studies - T. W. Edminster, Blacksburg, Va. - "Mr. Walter Turner, Soil Scientist, reports that laboratory permeability determinations for Sites VA-201 through 209 and 211 through 213 have been completed. On hand for completion are Sites VA-214 through 217 and 221 through 223. Mr. George T. Jackson, Soil Scientist, Tennessee, spent several days in the field and laboratory with Mr. Turner observing and participating in the permeability work in preparation for doing similar work in Tennessee. Mr. Turner also prepared a series of notes and observations pertaining to the measurement of soil characteristics affecting drainage to be used in the discussion at the Tile, Depth, and Spacing Meeting to be held in Chicago in December.

"Mr. J. Phelps Walker, Drainage Engineer, makes the following report:

"The assistance of Professor M. E. Terry, VPI Statistics Department, was secured to start analyzing some of the data secured from the pump unit on the Lee farm (Site 12). The objective of the analysis was to determine the possibility of relationship between water-table heights and the various meteorological elements - soil and air temperature, barometric pressure, and rainfall. Professor Terry selected the following plan of approach:

1. Make a preliminary analysis from a selected body of representative data.
2. Prepare a regression equation.
3. Calculate analysis of variance between observed field data and regression equation.
4. Assuming that relationships can be established between some of the meteorological elements and water-table elevation, draw up plans for analyzing all available data.

The Drainage Engineer assisted the Project Supervisor in preparing a paper "Drainage in Conservation Farming," which was presented by the Project Supervisor as a part of a panel discussion on water-control problems at the Annual Meeting of the Soil Conservation Society of America held at St. Louis on November 10-12."

Supplemental Irrigation - T. W. Edminster, Blacksburg, Va.-"The yields from the corn plots were computed and on the basis of sound corn the irrigated plots produced an average of 97.78 bushels per acre to 64.63 bushels per acre on the non-irrigated plots. This is an increase of 33 percent even with an exceptionally wet season."

Drainage Studies - Ellis G. Diseker, Raleigh, North Carolina.-"For the past 2 months the No. 2 pump would lose its prime occasionally when the water table was low, in which case it did not require frequent pumping. The foot valve was checked and found to be holding satisfactorily, and no leaks could be located except around the pump shaft above the impeller. Occasionally, when the pump drew the water down and stopped operating, air then could be heard entering around the impeller shaft and bearing. The bearing is water lubricated and lightly packed with two small circular felt washers. It has always leaked water. A new bearing and new washers were installed, however, this did not remedy the problem. It was concluded that the air entering around the impeller shaft caused the water to siphon over the water trap, thus lowering the water below the impeller, causing a loss of prime. Next, the height of the water trap was raised 4 inches. This decreased the rapidity of the loss of prime but did not solve the problem. Therefore, the discharge line on the opposite side of the water trap (away from the pump) was tapped and equipped with a 1/4-inch pipe. An improvised air valve was made from an alexite fitting by shortening the valve spring, and was fitted to the top of the 1/4-inch pipe. The valve closes when the pump is operating and prevents water from being pumped out near the pump. This valve also prevents freezing of the air vent. It releases and permits air to enter the discharge line when the pump is cut off. This solved the problem."

Drainage Studies - John C. Stephens, West Palm Beach, Florida.-"In 1942 cross sections were made every 200 feet along a 2,400-foot reach of the North New River Canal just below the Broward-Palm Beach County line when a 'slope course' was established for determining values of 'n.' A re-survey was made of the reach over the same sections to determine the change in cross-sectional shape during the intervening 7 years. The original and recent sections were superimposed upon each other and plotted on a scale of 5 feet to the inch and planimetered. The area below bank full stage in 1949 was 643 square feet as against 585 square feet in 1942, and the hydraulic radius was 7.74 feet as against 7.07 feet. Thus the water-carrying capacity of the canal has been increased, presumably, by the high velocities which occurred during the floods of 1947 and 1948 and which scoured the channel to bed rock in many places. The value AR ²/₃ of the channel being 2,516 in 1949 as compared to 2,155 in 1942, or an increase of approximately 14 percent. The increase in this canal is in direct contrast to a decrease of approximately 40 percent which occurred in the Cross Canal where flow was not enough to sweep out the accumulated sludge deposits."

Drainage Studies - M. H. Gallatin, Homestead, Florida.--"Rainfall for the period for the area varied from 0.21 to 6.54 inches. The greater portion of this occurred on November 13 and 14. Rainfall prior to this consisted of scattered light showers. From November 14 to the end of the month no rain fell. The heaviest rains occurred in the west and southwestern portion of the area.

"Readings made during this period to November 13 showed a slow steady increase for both the natural cover and check plots. On November 13 approximately 2 inches of rain fell in this area and as a result the moisture was at saturation on November 15. From November 14 to the end of the period no rain fell in this area and as a result readings increased steadily. The wilting point of the soil in the natural cover and check plots was reached during the week of November 22 to November 28. For the shavings, pine straw, and grass mulched areas we had slight increase in our readings to November 13. The heavy rain on November 14 built up the moisture content with succeeding lowering of the readings of our moisture blocks. Since November 14 we have had a gradual increase in our readings but not nearly so rapidly as for the natural cover and check plots. Our data to date show that grass or pine straw where available, are superior to shavings as a mulching material for young trees. These plots have been in operation for 2 years and examination of the various materials shows that there has been very little deterioration of the shavings material while in the grass and pine straw plots there has been a breakdown of the materials which has increased the organic matter content of the plot areas. It has also been noted that there is a marked decrease in the organic matter content of the soil in the check plot.

"Readings made during this period October 31 to November 12 showed a steady decrease in moisture content as the occasional showers during this period were not heavy enough to supply plant needs. With rains of 1 to 2.5 inches on November 14 moisture readings were lowered to near saturation. From November 14 to the end of the period we have had a steady increase in our readings. On November 22 the moisture blocks in the lime planting showed that the trees were near the wilting point. Ordinarily irrigation would be started but the growers endeavor during this time of the year to slow up growth and throw their trees into a dormant period. In the avocado block, because of the heavy leaf canopy and heavy mulch, though the readings indicated a trend of lowering moisture, it had not reached a critical point.

"In endeavoring to accumulate data on leaching under different conditions, that is, not only variations in cover and amounts of organic matter, but also different or variable amounts of water application, we have utilized in this study our rainfall data. We are to cover the various conditions in a cooperative study with nine of the grove owners in the area, and have plots set up in 19 groves. These areas were selected on the basis of maturity and cultural practices carried on by the growers. We have found that by utilization of our rainfall data along with irrigation application we have been able to carry on this project much faster. During the past period over a part of the area on November 13 we had a rain of short duration of 1 - 2.5 inches which occurred in approximately 1 hour. By utilization of these data we are able to continue this study during the period when irrigation is not practiced. Except for the rain occurring on November 13 we found that we had very little leaching during this period."

DIVISION OF IRRIGATION AND WATER CONSERVATION

Lining of Irrigation Canals and Ditches - C. W. Lauritzen, Logan, Utah.-"Butyl coated Fiberglas and commercial Fibrylon tubing were tested to determine permissible water pressure. Pressures of 3 to 4 pounds per square inch caused ballooning and eventual rupturing of the Butyl coated Fiberglas tubing. Apparently the failure was associated primarily with the poor bond of the Butyl coating to the Fiberglas reinforcing. The Fibrylon tubing began to develop leaks at 17 to 18 pounds pressure and failed at 25 pounds per square inch. Leaks and failures originated in the vicinity of the cemented joints connecting the spiles. It is believed that tubing without spiles would probably withstand greater pressures.

"Fabrics being rot tested were removed from the compost and inspected. The Butyl coated Fabrics, for the most part, showed little deterioration after a year and one-half. There was some slight evidence of fabric deterioration along the edges of the Butyl coated Cotton Drill and Butyl coated Rayon samples. The Jute in the Butyl coated Jute almost completely deteriorated, the rot extending to the center of the samples. Eighteen materials used for the manufacturing of bags were tested. These were placed in the compost July 22 and were inspected on November 1, after a period of a little more than 2 months; all had completely disintegrated, except the rubber coating which was used as a facing on one of these samples. Other samples under test had changed little for one reason or another."

Management of Related Irrigation and Drainage Enterprises - J. Howard Maughan, Logan, Utah.-"Irrigation is the direct and primary cause of the need for drainage in the Cub River Irrigation Company area. This striking relationship is especially apparent in the Lewiston-Fairview area. The 17,000-acre tract presents a perched water table which receives its water supply solely from irrigation and precipitation. In a study of irrigation and drainage in this area the water supply by sources is being measured. Likewise measurements of outflow are to be made to determine the net water supply available within the area."

Water Spreading for Recharge of Underground Basins - A. T. Mitchelson, Dean C. Muckel, E. S. Bliss, Curtis E. Johnson - San Joaquin Valley.-"At the Bakersfield laboratory, eighteen 2-inch percolation tubes were started on November 3. This experiment was designed primarily to test different tube-packing procedures. Object was to determine the best method of eliminating variation in percolation rates due to packing, and get an idea of the range in percolation rates to be expected when using each packing procedure. Results to date are summarized below:

(1) All of the five packing procedures followed resulted in percolation rates that varied over about the same range in terms of c.c. per hour. In terms of percent of group average, the most carefully packed tubes showed the widest variation. A larger group would be needed to test this statistically.

(2) The most carefully packed (adding 10-gram increments and tamping each increment 10 times with a special tamper) gave an average percolation rate just about one-half as great as the rate obtained by pouring the total amount of soil into the tube and tamping only enough to make it firm. Other methods tested (adding intermediate-sized increments, with different tamping procedure) resulted in rates between the above-mentioned extremes.

(3) Well-defined fluctuations in hourly percolation rates occur due apparently to temperature changes. All tubes seem to respond in the same way.

(4) Keeping the tubes running 24 hours per day, or clamping them off at night (maintaining a constant head of water over them) seems to give the same results.

"The next phase of this experiment, to be begun shortly, will be to try the effect of one or two treatments on percolation rates.

"In another experiment, a core was obtained with the Utah power auger and a section encased in the split lucite tube secured from Logan. The first cores tried were so dry that they crumbled, so another was taken about 8 feet from one of the ponds. This was slightly too wet so that in places small pieces of soil had been broken off by the cutting bit. However, the best section was encased in the split lucite tube. It was noted that the tube did not fit the core in a number of places, but the tube was set up and a head of water maintained on it for 24 hours. At the end of this time it was impossible to tell how much, if any, of the small amount of water going through was moving down the sides, so concentrated fluoresceine dye was added to the water supply. After 12 hours the fluoresceine had not come through but was moving down the sides to some extent. The core was to be dissected as soon as the dye appeared in the leachate.

"Further tests with the soil-coring machine and lucite tube were planned for December, with several spots being pre-soaked to insure proper soil-moisture content.

"Routing soil-moisture work, water analysis and mechanical analysis was carried on as time permitted. Further study of the water-analysis data was made but no conclusions were ready.

"Various kinds of media for making total counts of bacteria and actinomycetes were being tested in an effort to find one more suitable than those now being used. Modifications of media for fungi studies were also being tested.

Miscellaneous water spreading.- "At the request of Carl Fossetta, Executive Secretary, West Basin Water Association, a meeting with him, W. C. Ferquhar, Richfield Oil Corporation and Director of the West Basin Association, and George Gleason, California Division of Water Resources, was attended on November 1, so as to discuss recent developments in water spreading. The West Basin Association has plans to utilize sewage effluent for spreading in an overdrawn area near Hermosa Beach so as to prevent further intrusion of sea water. It was stated that \$1,500,000 worth of water (based on Metropolitan Water District prices) was pumped from this one small basin last year. Salt-water intrusion now endangers the entire basin as a usable reservoir. The present water table stands 10 to 50 feet below sea level."

Irrigation and Rainfall Penetration Studies - Dean C. Muckel, Pomona, California.- "Deep penetration consisting of return flow from irrigation water and rains on the valley floor were calculated for the Yucaipa-Beaumont groundwater area in the Yucaipa Valley Soil Conservation District, San Bernardino County. The following table shows the annual deep penetration in acre-feet and the percent of the long-time average for each year:

: Deep penetration ::			: Deep penetration		
Year	:	Ratio to	Year	:	Ratio to
:	Quantity	: average	:	Quantity	: average
	<u>Ac. ft.</u>	<u>Percent</u>		<u>Ac. ft.</u>	<u>Percent</u>
1927-28	2,600	22	1938-39	6,800	59
1928-29	2,400	21	1939-40	10,700	93
1929-30	3,200	28	1940-41	43,700	377
1930-31	3,400	29	1941-42	2,600	22
1931-32	28,900	249	1942-43	17,900	155
1932-33	3,800	33	1943-44	8,400	73
1933-34	2,100	18	1944-45	6,100	53
1934-35	11,300	98	1945-46	1,900	16
1935-36	8,900	77	1946-47	2,500	22
1936-37	48,400	417	1947-48	1,800	16
1937-38	25,800	222			

Note: The average annual penetration for the period 1927-38 is 11,581 acre-feet, and the median is 6,100 acre-feet.

"It is interesting to note that of the 21 years of record, the penetration exceeded the average in only five and was below average in 16 years. This emphasizes the importance of the ground-water basins as storage reservoirs. Owning to the enormous storage capacity it was possible to store the water of extremely wet years for use during dry periods.

"For the 5-year period ending with the 1947-48 season, the deep penetration averaged only 36 percent of the 21-year average and for the 3-year period ending with the 1947-48 season, the deep penetration averaged only 18 percent of the long-time average. This shortage of Ground Water Replenishment has been reflected in the ground-water levels, and is one of the principal reasons why they have declined so rapidly during the past few years."

Tile Drainage Studies, Imperial Valley, Calif. - George B. Bradshaw, Imperial, California.-"Investigations over a period of 8 years in the Imperial Irrigation District indicate the reduction of the salinity content of tile drainage effluent is very slow. The surface foot or two of soil can be freed of salinity relatively rapidly by ponding water on the surface and leaching out or driving the salt to a lower level. The salts that are driven to a lower level are then removed, over a period of time, by the tile drainage system.

"Heavy soils sometimes contain as many as 150,000 parts per million (p. p. m.) of dissolved salts, or approximately 300 tons of salt per acre, in the surface foot of soil. Drainage effluent from a heavy soil such as this initially runs around 52,000 p. p. m. and after 7 or 8 years of drainage the effluent may still contain 37,000 p. p. m. of dissolved salts.

"Light soils hold less salt than heavy ones and are reclaimed in a much shorter period of time. The drainage effluent from light saline soils initially runs about 15,000 p. p. m. of dissolved salts and will take 3 or 4 years for the salt content of the drainage effluent to reduce half.

"The salinity trends are currently being observed on 100 tile drainage systems that vary in age from 1942 to the present time."

Drainage Studies in San Fernando Valley, Calif. - William W. Donnan, Los Angeles, California. - "Additional analysis has been made of the data from some seventy 15-foot piezometer observation wells in the San Fernando Valley. These wells were installed over a period of years, the first ones being established in March 1945. The readings, which have been made monthly, provide a valuable source of information on the entire drainage problem. A review of the latest reading taken on November 10, 1949, reveals that although the San Fernando Valley has experienced perhaps the driest two consecutive years of record, the water table has not receded in selected locations over the western end of the valley. The rainfall for 1947-48 was about 38 percent of normal, and for 1948-49 was about 71 percent of normal; yet the water table this fall, after a 6 months dry season, has been recorded at about the same relatively high position as in 1945, a wet year. The places where the water table continues to stay at a high level are all adjacent to the artesian and semi-artesian wells of the valley. In other areas, where there are no artesian wells, the water table has receded to a point below the 15-foot level. This analysis further emphasizes the significance of the artesian wells in the drainage problem of western Fernando Valley."

"G. Marvin Litz, Los Angeles, California. "A land-use map for 1949 has been completed of the southwest portion of the San Fernando Soil Conservation District, containing the high water-table problem. The map covering an area of about 24 square miles, shows in detail each parcel of land appropriately numbered with a land-use classifications include irrigated, dry-farm, native vegetation, residential and industrial areas.

"Comparison of the 1949 map with a similar one of the same area for 1948 shows a continued increase in residential acreage. Citrus acreage increased but there was no change in the walnut and deciduous acreage. Alfalfa and other irrigated crop acreages remain about the same but there was an interchange of land use between parcels indicating favorable crop rotation practices.

"In the areas of highest water table, the water table remained high until late spring and was responsible for the abandoning of 80 acres of crop land, delaying the planting of 65 acres until late June, and killing about two-thirds of the stand of alfalfa on an additional 60 acres."

Soil Permeability Studies - V. S. Aronovici, Pomona, California. - "A comprehensive review is being made of all permeability runs completed in this laboratory over the past 2 years. These measurements are being summarized in tabular form including associated physical characteristics of the soil such as volume weight, total porosity, large pores, etc. More than a hundred southern California stations will be included in this summary."

Friction Losses in Pipes and Fittings - Carl Rohwer, Ft. Collins, Colo. - "The revised edition of the report on Friction Losses in Selected Valves and Fittings for Irrigation Pumping Plants has been completed. Publication of the report was discussed with Dr. Peterson, Head of the Civil Engineering Department of the College. He has set aside \$200 to help defray the cost of printing the report. It is hoped that additional funds can be obtained from other sources so that it will be possible to get the report published."

Seepage Losses from Irrigation Channels - Carl Rohwer, Ft. Collins, Colorado. - "A series of tests of the loss at various depths from the seepage rings at the Horticultural plots near the Hydraulic laboratory has been completed. These tests were made at depths ranging from 2 inches to 24 inches. A continuous record covering the period from October 22 to date has been obtained. The loss is measured by volumetric water meters attached to each tank. Periodic measurements of the rate of drop when the water is shut off are also being obtained as a check on the water-meter record. From time to time measurement of the seepage inside the rings has been made with a permeameter. The losses measured by the permeameter have, however, been consistently less than those indicated by the rate of drop in the tank.

"A permeameter of the type proposed by the Bureau of Reclamation has been constructed and has been given preliminary tests by Mr. Ralph Rollins who is also working on this project. These tests have not yielded consistent results and the device is now being tested in the laboratory to find out why it is not working properly. Work on the seepage project will be continued as long as the weather remains favorable."

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